

## **MANAGING GRAPHIC DATABASES**

### **TECHNICAL FIELD**

5       The present invention relates to managing graphical databases in association with communication networks and more specifically to searching and maintaining graphic databases for access in enterprise networks.

### **BACKGROUND OF THE INVENTION**

10       Computer programs are widely available for creating drawings and other documents with graphic content. These programs incorporate a variety of tools to aid a user in creating and manipulating graphics, such as icons, images, drawings, diagrams, clip art, artwork, pictures, symbols, line drawings, and similar visual content through a computer and its associated user interface ("UI"). In addition to creating graphics from scratch, a user may acquire a predefined  
15       graphic from a graphic database and subsequently customize its color, size, orientation, shape, or other feature.

      Suppliers of graphics frequently supply graphic databases written onto one or more compact disk read-only memory ("CD-ROM") devices or similar optical medium. Configuring the graphics in the database in an industry-  
20       standard format facilitates compatibility with software programs from a wide range of vendors. Alternatively, a software vendor may supply a proprietary graphic database coupled to a drawing software package. The process of installing the drawing software onto a computer loads the graphic database onto the computer's hard drive so a user can quickly access the database's graphics.

25       In addition to providing a graphic database installed on a user's hard drive, a software vendor may provide access to a central graphic database over a wide-area network ("WAN"). For example, a vendor may offer access over the Internet, which is a WAN, to a public database of graphic content using a configuration that provides exclusive access to users of the vendor's software. A  
30       module in the software that is resident on the user's computer directs the software

to communicate over the Internet with the vendor's site when the user requests graphic content. The vendor may regularly append and update the public database to enhance the value of the graphic database to its customers and to adapt to trends in the graphic preferences of users.

5               While conventional WAN-based public graphic databases are suited to graphic updates, the graphic file sizes can impede the speed with which a remote user accesses graphics from such a database. To address file transfer speed limitations, the communication link between the user and the remote database may include an application server page ("ASP") that functions as a  
10       database gateway and facilitates expeditious information transfer. The ASP accepts user search requests, communicates with a server to seek graphics that meet the search terms, and returns metadata to the user. If a user determines that a graphic is acceptable based on the metadata, the user may elect to download the full graphic file.

15               Although relaying metadata through ASPs promotes efficient transfer of graphics, such transfer is generally implemented over a WAN, such as the Internet. Data that is transferring across such a WAN encounters potential time delays associated with the physical expanse of the WAN, communication bottlenecks such as WAN access interfaces, and other communication  
20       impediments.

              Another problem with typical WAN-based graphic databases is that all users do not have the Internet connectivity generally associated with accessing the database. Certain enterprises have internal computer networks that are disconnected, locked down, or otherwise isolated from the Internet or other WAN.  
25       Some users' connectivity may be intermittent, slow, or unreliable. Furthermore, a fault in the WAN communication link between the user and the WAN-based graphic can disrupt a user's database access.

              In addition to having communication-related limitations, WAN-based graphic databases are usually public databases that offer the same content to  
30       all the users that they serve. The content is often optimized to maximize the

number of graphic choices that are available to users. Such databases generally lack provisions to provide a user with custom graphics or graphic sets that are specifically tailored to meet the standardization requirements of a specific user or set of users. That is, conventional WAN-based databases are usually incompatible  
5 with the needs of enterprises that seek to provide their internal users with a standard, consistent graphic set.

To address these representative deficiencies in the graphic database art, what is needed is a capability for managing graphic databases that serves users that are disconnected or otherwise isolated from the Internet or other WAN.  
10 Further a capability is needed to provide enterprise-based users with graphic sets that are tailored to meet specific content needs of the enterprise. Such capabilities would benefit users that need graphic content for insertion into drawings and other documents.

## 15 SUMMARY OF THE INVENTION

The present invention supports providing users in an enterprise with access to a database of graphics. In one aspect of the present invention, a public graphic library is accessible to software users via the Internet or other network that spans a large geographic area and/or offers unrestricted access.  
20 Using Internet connectivity, users can download graphics for insertion into drawings and other documents. An administrator of this public graphic library can regularly update the graphic content of the library. Another graphic library can be coupled to a computer network in an enterprise, such as a business or other organization, to serve users of the enterprise that lack open access to the public  
25 graphic library. This enterprise graphic library can include content, in whole or in part, from the public graphic library. Access to the enterprise graphic library can be restricted to the enterprise's users and others having authorization.

In another aspect of the present invention, a software program or module can include a configuration that can point either to the public graphic  
30 library on the Internet or the enterprise graphic library on the enterprise's network.

Configuring the software so that it points to the public graphic library can direct graphic communication between the software and the public graphic library so a user can download graphics from the public graphic library over the Internet. On the other hand, configuring the software so that it points to the enterprise graphic library can direct graphic communication between the software and the enterprise graphic library so a user can download graphics from the enterprise's graphic library over the enterprise's network. The configuration can include a network address that points to the network location of a graphic library. The address can be written into a configuration database associated with the operating system of the computer upon which the software runs, for example setting a registry key.

In another aspect of the present invention, the public graphic library and the enterprise graphic library can include parallel functionality. Duplicating the functionality of the public graphic library in the enterprise graphic library can facilitate the software communicating with the enterprise library in large part as if it was the public graphic library. The software can communicate with either the enterprise graphic library or the public graphic library using common communication methods such as protocols and standards. An information gateway that provides a centralized communication point in the public graphic library can correspond to an information gateway in the enterprise graphic library that provides parallel functionality. These gateways can be ASPs.

In yet another aspect of the present invention, a user can search a remote graphic library for a suitable graphic. The user can enter search terms that can be transmitted to the library. The library can return a list of graphics that match the search term along with a textual description and an abridged graphic, such as a bitmapped image, for each listed graphic. When the user selects a specific graphic from the list for insertion into a drawing, the library can transmit the full, unabridged graphic. Transmitting a list of abridged images in preparation for transmitting a full graphic from the list can promote timely transfer of graphical data.

The discussion of graphic databases presented in this summary is for illustrative purposes only. Various aspects of the present invention may be more clearly understood and appreciated from a review of the following detailed description of the disclosed embodiments and by reference to the drawings and  
5 claims.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

Figures 1 is a functional block diagram illustrating an operating environment according to an exemplary embodiment of the present invention.

10 Figure 2 is a functional block diagram illustrating an enterprise coupled to a public graphic library via a WAN and another enterprise coupled to an enterprise graphic library via a LAN according to an exemplary embodiment of the present invention.

Figure 3 illustrates a drawing software module with a remote  
15 library director that directs communication to either a public graphic library or an enterprise graphic library according to an exemplary embodiment of the present invention.

Figures 4A, 4B, and 4C illustrate local, enterprise, and public databases according to exemplary embodiments of the present invention.

20 Figure 5 illustrates a user interface for setting graphic search preferences according to an exemplary embodiment of the present invention.

Figures 6A and 6B illustrate selecting a graphic from a search window and inserting the selected graphic on a drawing page according to an exemplary embodiment of the present invention.

25 Figure 7 illustrates a process for searching a remote graphic library and downloading graphics according to an exemplary embodiment of the present invention.

Figures 8A and 8B illustrate a routine for locating graphics according to an exemplary embodiment of the present invention.

Figures 9A and 9B illustrate a routine for downloading a graphic and inserting it into a drawing according to an exemplary embodiment of the present invention.

## 5 DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The present invention is directed to managing, networking, and accessing graphic databases in a manner that provides database access to enterprise-based users that are disconnected or otherwise isolated from the Internet or another WAN and/or that are impeded from downloading graphics  
10 from WAN-based graphic databases.

Turning now to discuss each of the drawings presented in Figures 1-9, in which like numerals indicate like elements throughout the several figures, an exemplary operating environment and an exemplary embodiment of the present invention will be described in detail.

15 Figure 1 illustrates an exemplary operating environment for implementation of the present invention according to one embodiment of the present invention. The exemplary operating environment includes a general-purpose computing device in the form of a conventional personal computer 120, as exemplified by the architectural overview 100 in Figure 1. Generally, the  
20 personal computer 120 includes a processing unit 121, a system memory 122, and a system bus 123 that couples various system components including the system memory 122 to the processing unit 121. The system bus 123 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The  
25 system memory 122 includes a read-only memory ("ROM") 124 and a random access memory ("RAM") 125. A basic input/output system ("BIOS") 126, containing the basic routines that help to transfer information between elements within the personal computer 120, such as during startup, is stored in ROM 124.

The personal computer 120 further includes a hard disk drive/hard  
30 disk 127, a magnetic disk drive 128 for reading from or writing to a removable

magnetic disk 129, and an optical disk drive 130 for reading from or writing to a removable optical disk 131 such as a compact disk read-only memory ("CD-ROM") or other optical media. The hard disk drive 127, magnetic disk drive 128, and optical disk drive 130 are each connected to the system bus 123 by a hard disk drive interface 132, a magnetic disk drive interface 133, and an optical disk drive interface 134, respectively.

Although the exemplary environment described herein employs a hard disk 127, a removable magnetic disk 129, and a removable optical disk 131, it should be appreciated by those skilled in the art that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, RAMs, ROMs, and the like, may also be used in the exemplary operating environment. The drives and their associated computer readable media provide nonvolatile storage of computer-executable instructions, data structures, program modules, and other data for the personal computer 120.

A number of program modules may be stored on the hard disk 127, magnetic disk 129, optical disk 131, ROM 124, or RAM 125, including an operating system 135 and a drawing software module 175. Program modules include routines, sub-routines, programs, objects, components, data structures, etc., which perform particular tasks or implement particular abstract data types. Aspects of the present invention may be implemented in the form of a drawing software module 175. Storing frequently used data on the hard drive 127 facilitates expeditious access by active software running on the computer 120, for example the drawing software module 175 has ready access to graphics from the local graphic database 180.

A user may enter commands and information into the personal computer 120 through input devices, such as a keyboard 140 and a pointing device 142. Pointing devices may include a mouse, a trackball, and an electronic pen that can be used in conjunction with an electronic tablet. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or

the like. These and other input devices are often connected to the processing unit 122 through a serial port interface 146 that is coupled to the system bus 123, but may be connected by other interfaces, such as a parallel port, game port, a universal serial bus (“USB”), or the like. A display device 147 may also be  
5 connected to the system bus 123 via an interface, such as a video adapter 148. In addition to the monitor 147, personal computers typically include other peripheral output devices (not shown), such as speakers and printers.

The pointing device 142 can control a pointer, such as a cursor on a displayed, or electronic, page. Moving a mouse or a trackball, for example, can  
10 adjust the position of the pointer on the displayed page. The pointing device 142 can also include a button or similar feature through which a user can communicate with software routines executing in the computer system 120. For example, a user of a drawing software package can position the pointer over an object on an electronic page and depress the button to select the object. With the object  
15 selected and the pointing device button in the depressed state, the user can reposition the object on the page and release the click to set the object into its new position on the page using a drag-and-drop gesture.

The personal computer 120 may operate in a networked environment using logical connections to one or more remote computers 149. A  
20 remote computer 149 may be another personal computer, a server, a client, a router, a network personal computer, a peer device, or other common network node. While a remote computer 149 typically includes many or all of the elements described above relative to the personal computer 120, only its memory storage device 150 has been illustrated in Figure 1. The logical connections  
25 depicted in Figure 1 include a local-area network (“LAN”) 151 and a WAN 152. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets, and the Internet.

When used in a LAN networking environment, the personal computer 120 is often connected to the LAN 151 through a network interface or  
30 adapter 153. When used in a WAN networking environment, the personal

computer 120 typically includes a modem 154 or other apparatus for establishing communications over a WAN 152, such as the Internet. The modem 154, which may be internal or external, is connected to a system bus 123 via serial port interface 146. In a networked environment, programs such as the drawing software module 175, can access information, such as a graphic, from a remote database 190 of information via the LAN 151 or the WAN 152. It will be appreciated that the network connections shown are exemplary and other provisions for establishing a communications link between the computers may be used.

Moreover, those skilled in the art will appreciate that the present invention may be implemented in other computer system configurations, including handheld devices, multiprocessor systems, microprocessor based or programmable consumer electronics, network personal computers, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments, where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

In one exemplary embodiment of the present invention, the present invention includes hardware and software components illustrated in Figure 1. That is, an exemplary embodiment of the present invention includes a computer 120, LAN 151, WAN 152, drawing software module 175, and one or more types of remote databases 175, as will be discussed below in reference to Figures 2-9.

The term "enterprise," as used herein, refers to an organization, such as a business, school, government department, military base, association, political unit, or other institution, that utilizes computers. An enterprise can be located in a single facility, physically concentrated in a campus or other collection of buildings, or dispersed across a geographic area.

The term "enterprise network," as used herein, refers to a computer network, such as a LAN 151 or campus-area network ("CAN"), that serves a

specific enterprise. The terms “LAN” and “local-area network,” as used herein, refer to a computer network that spans a relatively small area. Most LANs 151 are confined to a single building or group of buildings. An Ethernet is an example of a LAN 151.

5                   An “intranet,” as used herein, refers to an enterprise network based on Internet protocols that is accessible only by the enterprise’s constituents and others with authorization. Secure intranets are either disconnected from the Internet or otherwise isolated by a firewall or other device that restricts network access. An intranet’s websites look and function in a manner similar to Internet  
10 Web sites.

                  The terms “WAN” and “wide-area network,” as used herein, refer to a computer network that spans a relatively large geographic area and typically includes a connection between two or more LANs 151. The Internet is a WAN 152 that is a global network connecting millions of computers. A metropolitan-  
15 area network (“MAN”) is type of WAN 152 that is configured for a town, city, or metropolitan area. While WANs 152 often include communication links through a public network such as the telephone system, they can also include leased lines or satellites.

                  The term “public,” as used herein in connection with a network,  
20 library, or database, refers to a network, library, or database having access that is not restricted to the constituents of a specific enterprise and others having authorization. For example, a network, library, or database that is accessible only to purchasers of a specific software package is typically public since those purchasers come from multiple businesses or other enterprises. In contrast, the  
25 term “private,” as used herein in connection with a network, library, or database, refers to a network, library, or database this is accessible only to a defined set of users and others with authorization. Private databases often have content that is customized to the needs of a specific enterprise, for example.

                  In addition to these networking terms, other terminology will be  
30 referenced and described in conjunction with the discussions below. The present

invention includes multiple computer programs which embody the functions described herein and illustrated in the exemplary displays, functional block diagrams, and the appended flow charts. However, it should be apparent that there could be many different ways of implementing the invention in computer programming, and the invention should not be construed as limited to any one set of computer program instructions. Further, a skilled programmer would be able to write such a computer program to implement the disclosed invention without difficulty based on the exemplary displays, functional block diagrams, and flow charts and associated description in the application text, for example.

Therefore, disclosure of a particular set of program code instructions is not considered necessary for an adequate understanding of how to make and use the invention. The inventive functionality of the computer program aspects of the present invention will be explained in more detail in the following description in conjunction with the remaining figures illustrating the functions and program flow.

Certain steps in the processes described below must naturally precede others for the present invention to function as described. However, the present invention is not limited to the order of the steps described if such order or sequence does not alter the functionality of the present invention. That is, it is recognized that some steps may be performed before or after other steps or in parallel with other steps without departing from the scope and spirit of the present invention.

Processes and components of an exemplary embodiment of the present invention will be further described in reference to Figures 2 - 9. Turning now to Figure 2, this figure is a functional block diagram **200** illustrating an enterprise **205** coupled to a public graphic library **210** via a WAN **152** and another enterprise **215** coupled to an enterprise graphic library **220** via a LAN **151** according to an exemplary embodiment of the present invention. The enterprise **215** with the enterprise graphic library **220** is illustrated in a state of disconnection from the WAN **152** that serves as a bridge to the public graphic library **210**.

The WAN-connected enterprise 205 includes a LAN 151 of computers 120 with a router 230 that provides access to the WAN 152. This communication system affords the users of the enterprise 205, who interface with these computers 120, access resources over the WAN 152. Although Figure 2  
5 depicts a single WAN-connected enterprise 205, numerous WAN-connected enterprises 205 and individual users typically couple to the public graphic library 210 from various sites on the WAN 152.

In one embodiment of the present invention, the WAN 152 is the Internet 152 and the computers 120 and router 230 communicate with the Internet  
10 152 using the Internet's standard suite of communication protocols. In one embodiment of the present invention, this protocol is transmission control protocol/Internet protocol ("TCP/IP").

A public graphics library 210 resides on the WAN 152 at a location that is distinct from the WAN-connected enterprise 205. The public graphics  
15 library 210 includes a public graphic database 235 associated with an Internet server 225. The public graphic database 235 is a database of public graphic content that is accessible to the computers 120 in the WAN-connected enterprise 205 and other individual users and entities that have access to the WAN 152 from an Internet service provider ("ISP") or other access arrangement.

20 The public graphic database 235 contains a wide assortment of graphics, such as drawings, diagrams, clip art, symbols, line drawings, images, and other visual content useful to the public graphic library's clients. Typical content includes two-dimensional and perspective line representations of flow chart shapes, electrical symbols, marketing diagrams, computing illustrations, call  
25 out bubbles, and many other images.

In one exemplary embodiment of the present invention, the content of the public graphic database 235 is voluminous so as to meet the varied image needs and preferences of a wide range of users. For example, this database 235 might feature an assortment of styles of electrical symbols, each style meeting the  
30 standards of a different standards-governing body or the preferences of an

engineering firm. Users needing to comply with the European standards might select one electrical transformer symbol while those seeking to comply with United States standards might select a different symbol representative of a transformer.

5                   An administrator of the public graphic library 210 regularly updates the public graphic database 235 so it is current with changes in drawing standards and trends in user preferences. The administrator also analyzes the graphic requests that arrive at this library 210 and responds by augmenting content in popular areas and filling in content gaps as they become apparent.  
10                   Consequently, the public graphic database 235 evolves and expands over time.

                  In one exemplary embodiment of the present invention, a vendor of drawing software 175 configures and administers the public graphic library 210 to restrict accessibility to users of the vendor's software 175. In other words, a software vendor can design its drawing software modules 175 and the public  
15                   graphic library 210 so that the public graphic database 235 is exclusively compatible with this software 175.

                  In association with the graphic content, the public graphic library 210 contains metadata. Each metadata entry is linked to a specific graphic, and each graphic is linked to a specific metadata entry. The metadata for each graphic  
20                   includes a searchable textual description and an abridged image, such as a bit-mapped image, that has significantly fewer digital bytes than the graphic itself. In order to conserve communication bandwidth and expedite communication, the public graphic library 210 transmits metadata prior to sending a graphic over the WAN 152 to a user. If the user determines that the received metadata indicates  
25                   that a graphic is suitable, the user requests the full graphic and the public graphic library 210 complies with the request.

                  Like the WAN-connected enterprise 205, the WAN-disconnected enterprise 215 has a LAN 151 of computers 120 whose users lack immediate WAN-based access to the graphic resources of the public graphic database 235.  
30                   Any of numerous conditions can isolate the WAN-disconnected enterprise 215

from the WAN 152. A failure in an access point onto the WAN 152 or in a communication path between a computer 120 and the public graphic database 235 can cause isolation. If a low-speed connection couples the WAN-disconnected enterprise 215 to the WAN 152, but the connection lacks sufficient bandwidth to provide users with access to the public graphic library 210, then the enterprise 215 is disconnected from the WAN 152 in terms of connectivity to the public graphic library 210. Management of a WAN-disconnected enterprise may provide users with access to the WAN 152 but block their access to the public graphic library 210. The WAN-disconnected enterprise 215 may simply lack an Internet connection because such connection is unavailable in a geographic locale, due to economic reasons, or as a consequence of other circumstances. In other words, in a WAN-disconnected enterprise 215 can either be physically disconnected from the WAN 152 or otherwise isolated from WAN-based access to the remote graphic library 210. In one embodiment of the present invention, the WAN-disconnected enterprise's LAN 151 is a private network.

In place of the public graphic library 210, the WAN-disconnected enterprise 215 maintains an enterprise graphic library 220 coupled to its LAN 151. The enterprise graphic library 220 provides graphics to the users coupled to the LAN 151 of this enterprise 215. A LAN server 245 provides a link between the enterprise graphic database 250, which is a database of graphics similar to the public graphic database 235, and the LAN 151. That is, users on the LAN 151 remotely access the enterprise graphic database 250 over the LAN 151 via the LAN server 245.

In addition to providing the benefit of accessibility, connecting a graphic database directly to an enterprise's LAN 151 offers an enterprise 215 speed benefits for downloading and/or uploading graphics. Rather than configuring its user computers 120 and/or the associated software to access graphics remotely over the WAN 152, a WAN-disconnected enterprise 215 can setup and maintain a high-speed LAN network 151 coupled to the enterprise graphic database 250. Such a high-speed LAN network 151 is often more

economical than obtaining and maintaining a WAN connection providing equivalent bandwidth to the public graphic database 235.

The enterprise graphic database 250 receives graphic content 260 from the public graphic database 235 stored on a physical medium, such as a CD-ROM 131, as traditional mail over a physical mail communication link 255, such as United States Postal Service or other transportation service. When graphic updates 260 arrive from the public graphic library 210, the information technology ("IT") department of the WAN-disconnected enterprise 215 can elect to update the enterprise graphic database 250 with the new content 260. The IT department may implement a full database replacement to synchronize the enterprise graphic database 250 with the public graphic database 235. Alternatively, the IT department or other management personnel can opt to selectively modify the enterprise graphic database 250 with the new content 260. The updates 260 typically arrive periodically, for example semiannually, quarterly, or monthly.

As an alternative to receiving graphic content 260 written on a physical medium 260, the IT department of the WAN-disconnected enterprise 215 can communicate with the public graphics library 210 via a communication link, such as a WAN 152. In this case, the WAN-disconnected enterprise 215 maintains a WAN connection that is not directly available to users on the LAN 151 for downloading graphics from the public graphic database 235. The IT department downloads graphics from the public graphic database 235 at an appropriate time interval and loads the graphics, in full or in part, into the enterprise graphic database 250 where it is accessible to users on the LAN 151.

Turning now to Figure 3, this figure illustrates a drawing software module 175 installed on a computer 120 with a remote library director 320 that directs communication to either the public graphic library 210 or the enterprise graphic library 220 according to an exemplary embodiment of the present invention. A director is an element that specifies a communication destination. Configuring the remote library director 320 to communicate over the WAN 152 with the public graphic library 210 sets up the drawing software module 175 and

the computer 120 on which it resides to operate in a WAN-connected enterprise 205. On the other hand, configuring the remote library director 320 to communicate with the enterprise graphic library 220 on a LAN 151 inside a firewall 355 sets up the drawing software module 175 and computer 120 for a  
5 WAN-disconnected enterprise 215.

In one embodiment of the present invention, the remote library director 320 directs communication to both the enterprise graphic library 220 and the public graphic library 210 so that a user in a WAN-connected enterprise 205 that maintains an enterprise graphic library 220 gains access to multiple remote  
10 libraries 210, 220. With this capability, a user can search the enterprise graphic library 220 for graphics that are proprietary or otherwise specific to the WAN-connected enterprise 205 and search the public graphic library 210 for content that is public or otherwise nonexclusive to the WAN-connected enterprise 205. That is, a single search can locate graphics in a public graphic database 235, an  
15 enterprise graphic database 250, and a local graphic database 180 and return results from all three databases 235, 250, 180. Also, a user can specify one of these databases 235, 250, 180 as a search destination.

The drawing software module 175 is a software program through which a user creates drawings or other documents with graphic content, for  
20 example by inserting any of the exemplary graphics described herein onto a drawing page. In one exemplary embodiment of the present invention, the drawing software module 175 is a software program that helps users create business or technical diagrams.

According to one exemplary embodiment of the present invention,  
25 the drawing software module 175 is based on the drawing software product sold by Microsoft Corporation of Redmond, Washington under the registered trademark VISIO. In one exemplary embodiment of the present invention, the drawing software module 175 illustrated in Figure 3 is an adaptation of the VISIO 2003 program. As supplied, the VISIO 2003 program communicates with a  
30 public graphic library 210 maintained by Microsoft Corporation that provides

users of the VISIO 2003 program with remote access to graphics from a public graphic database 235 over the Internet 152. A fixed address that the VISIO 2003 program writes into the registry, which is a database used by the computer's operating system 122 to store configuration information, points to the location of this remote library site 235. Overriding this fixed address in the VISIO 2003 program by setting a registry key to a new address causes the VISIO 2003 program to attempt to establish communication with a remote graphic library 220 at the new address. The remote library director 320, which is not a component of the Visio 2003 program, provides this overwriting function. That is, overlaying the remote library director 320 on the VISIO 2003 program provides an exemplary software module 175 according to an embodiment of the present invention. In this configuration, the remote library director 320 directs the VISIO 2003 program to communicate with an enterprise graphic library 220 on a LAN 151 of a WAN-disconnected enterprise 215 by overwriting the address of the public graphic library 210 maintained by Microsoft Corporation with the LAN address of the enterprise graphic library 220.

The remote library director 320 can be a macro, script, batch file, standalone program, manual operation, physical component, or integral software component associated with the drawing software module 175. In one exemplary embodiment of the present invention, the remote library director 320 is a software configuration that is set prior to loading the drawing software module 175 on a computer 120. In another exemplary embodiment of the present invention, a user interface (not shown) accompanies the remote library director 320 so that a user can define the location of a specific remote graphic library or select one graphic library from a list of choices. As an alternative to writing the communication direction into a registry or other database associated with the computer's operating system, the present invention supports using a variety of elements for directing communication. For example, configuration files or internal storage coupled to a user interface can store communication addresses and other information associated with directing communication to a specific destination.

The remote library director **320** is a component of the drawing software module's graphic locator **305**. The graphic locator **305** receives user requests for graphics, coordinates acquisition of requested graphics, and transfers acquired graphics to software components (not shown) in the drawing software module **175** that store and display acquired graphics. The graphic locator **305** includes two software modules, a local graphic acquirer **315** and a remote graphic acquirer **310**, that it engages for these tasks. The local graphic acquirer **315** finds and acquires graphics stored locally in a local graphic database **180** on the hard drive **127** of the computer **120**. This local graphic database **180** stores a set of basic graphics and frequently-used graphics, such as graphics downloaded one or more times from a remote graphic library **210**, **220**. The remote graphic acquirer **310** finds and acquires graphics from either the public graphic library **210** or the enterprise graphic library **220** according to the configuration of the remote library director **320**.

Configuring the remote library director **320** to communicate with the public graphic library **210** sets up the drawing software module **175** for a WAN-connected enterprise **205**. In this state **325**, graphic requests from the remote graphic acquirer **310** propagate across the LAN **151** of the WAN-connected enterprise **205** to the router **230**, which typically serves as a demarcation point between the LAN **151** and the WAN **152**. The remote graphic acquirer generates these requests as extensible markup language ("XML") documents. The router **230** sends these XML documents through the firewall **355**, which prevents unauthorized access onto LAN **151**, and onto the WAN **152** towards the public graphic library **210**. An ASP **335** associated with an Internet information server ("IIS") **340** at the public graphic library **210** receives these XML documents and responds accordingly. The ASP **335** can be a dynamically created Web page with an .ASP extension that utilizes ActiveX scripting.

The ASP **335** is also linked to a public file server **345** and a public structured query language ("SQL") server **350** at the public graphic library **210**. That is, the public graphic base **235** is distributed between the IIS **340**, the public

file server 345, and the public SQL server 350. The public file server 345 contains graphic files, while the SQL server 350 contains metadata associated with each graphic. The SQL server 350 is a database management system (“DBMS”) that responds to queries formatted in SQL language from the ASP 335.

5           When the ASP 335 receives an inquiry for graphic metadata from the remote graphic acquirer 310 in the format of an XML document, it queries the SQL server 350. When the SQL server 350 supplies the requested metadata, the ASP 335 relays it back to the remote graphic acquirer 310. When the ASP 335 receives an inquiry for a full graphic file from the remote graphic acquirer 310, it  
10       acquires that graphic file from the public file server 345 and sends it to the remote graphic acquirer 310.

          In one embodiment of the present invention, a single server contains the IIS 340, the public file server 345, and the SQL server 350. That is, the IIS server 340, the public file server 345, and the SQL server 350 can be either  
15       virtual servers in a single enclosure or separate servers located in separate enclosures. Furthermore, the public file server 345 and the public SQL server 350 can be virtual servers within the IIS 340.

          For each illustrated component 335, 340, 345, 350 and function in the public graphic library 210, the enterprise graphic library 220 includes a  
20       corresponding component 360, 245, 370, 365, and function. The parallelism between these two remote libraries 210, 220 enables the remote graphic acquirer 310 to interact with the enterprise graphic library 220 as if it were the public graphic library 210. In other words, the communication destination, whether it is the public graphic library 210 or the enterprise graphic library 220, is essentially  
25       transparent to the remote graphic acquirer 310 in one exemplary embodiment of the present invention.

          When the remote library director 320 is configured to the enterprise graphic library state 330, the remote graphic acquirer’s XML documents arrive at the intranet ASP 360 on the LAN 151 within the firewall 355 rather than the  
30       Internet ASP 335 on the WAN 152. The intranet ASP 360 queries the enterprise

SQL server 365 for metadata or the enterprise file server 370 for full graphic files according to the content of the XML document. The intranet ASP 360 returns such information that it acquires from the enterprise SQL server 365 and the enterprise file server 370 to the location on the LAN 151 of the computer 120 that originated the graphic request. This computer 120 is within the LAN-disconnected enterprise 215 (shown in Figure 2).

The enterprise file server 370 and the enterprise SQL server 365 are typically virtual servers within a LAN server 245 associated with the intranet ASP 360. However, these three servers 245, 370, 365 can be distinct, interconnected hardware devices that are components of the enterprise graphic database 250.

Those skilled in the art appreciate that the communications, database management schemes, and programming languages described herein are exemplary and can practice the present invention using assorted database configurations, communication protocols and programming languages known in the art based on the description. For example, the public SQL server 350 and the private SQL server 365 can be servers that provide the functions described herein based on a programming language other than structured query language. And, communication between the remote graphic acquirer 310 and the Internet active server page 335 or the intranet active server page 360 can occur with various communication formats and languages other than the transmission of XML documents.

Those skilled in the art appreciate that using an ASP to access to a graphic database is exemplary and that the present invention supports a range of options for this function. The present invention can include web scripting modules such as hypertext preprocessor ("PHP"), practical extraction and report language ("Perl"), Java server page ("JSP"), or other alternatives known in the art. Furthermore, a range of web servers that are known to those skilled in the art can provide similar function to the exemplary IIS web server 340 discussed herein.

Turning now to Figures 4A, 4B, and 4C, these figures illustrate the content of local, enterprise, and public databases 180, 250, 235 according to three exemplary embodiments of the present invention.

Figure 4A illustrates a public graphic database 235, which is coupled to the WAN 152, containing periodically appended or otherwise updated content. Upon such revision, the administrator of this remote database 235 provides a copy to the administrator of the enterprise graphic database 250, such as the IT department of a WAN-disconnected enterprise 215. The public graphic database administrator can send the enterprise IT department either a full database backup or the public content revisions occurring since its last transmission of content. The IT department updates the enterprise graphic database 250 to synchronize its content changes with those of the public graphic database 235. That is, the content of the enterprise graphic database 250 is a duplicate of public graphic library's content. In this configuration 400, a user in a WAN-disconnected enterprise 215 accesses the same graphic content from the enterprise graphic database 250 that a user in a WAN-connected enterprise 205 accesses from the public graphic database 235. The local graphic database 180, which is maintained locally on the user's hard drive 127, contains frequently used graphics including a standard graphic set and downloaded graphics.

Figure 4B illustrates an exemplary embodiment of the present invention wherein the enterprise graphic database 250 includes content from the public graphic database 235 in addition to content generated by the WAN-disconnected enterprise 215 and/or third-party graphic sources. A WAN-disconnected enterprise 215 implements this database configuration 425 to provide its employees with a large selection of graphics, for example. When an employee generates a new graphic, the user may elect to upload it onto the enterprise graphic database 250 so other employees can access it.

Figure 4C illustrates another exemplary embodiment of the present invention wherein the WAN-disconnected enterprise 215 controls the enterprise graphic database 250 so that its content is specific to that enterprise 215. With

this control, the users on the LAN 151 of the WAN-disconnected enterprise 215 access consistent graphic content and generate drawings and other documents that exhibit a uniform appearance. The WAN-disconnected enterprise 215 can adopt a standard set of graphics so that each user on the LAN 151 uses the same architectural symbols or other symbols that are important to the enterprise's operations, for example. For example, the enterprise graphic database 250 can hold content that is not available on the public graphic database 235 such as internally produced graphics, logos, custom icons, or shapes that are unique to a company or organization. In one embodiment of the present invention, the enterprise graphic database 250 and the public graphic database 235 do not contain overlapping content.

In this database configuration 450, the management of the WAN-disconnected enterprise 215 screens the content updates that it receives from the public graphic library 210 and determines the content that is acceptable for inclusion its enterprise graphic database 250. Management adopts new content that will enhance the documents generated by the enterprise 215 without compromising its document standards and rejects unacceptable content. This enterprise graphic database 250 can be a private graphic database.

Figure 5 illustrates a user interface 500 for entering graphic search preferences according to an exemplary embodiment of the present invention. The drawing software module 175 displays this user interface window 500 when a user engages a pull down menu or provides another prompt. A user may elect to seek graphics from the local graphic database 180, a remote graphic database 235, 250, or both. When a user is isolated from both the WAN 152 and the LAN 151 and can access neither the public graphic library 210 nor the enterprise graphic library 220, the user can elect to access graphics exclusively from the local graphic database 180, for example.

When the user elects to seek graphics remotely, the state 325, 330 of the remote library director 320 defines the remote source as either the public graphic database 235 or the enterprise graphic database 250. In one exemplary

embodiment of the present invention, the graphic locator 305 searches for graphics from a remote graphic library 210, 220 only if the user opts for a remote search. And, if a user opts for a remote search the remote library director 320 defines destination of that search.

5                Figures 6A and 6B illustrate selecting a graphic from a search window 610 and inserting the selected graphic on a drawing page 605 according to an exemplary embodiment of the present invention. When a user desires to insert a graphic onto a drawing page 605, the user can enter a search term such as “computer keyboard” or other descriptor that describes the desired graphic. The  
10        graphic locator 305 responds to this entry and engages the remote graphic acquirer 310 and the local graphic acquirer 315 to find graphics that match the description.

              The local graphic acquirer 315 searches the local graphic database 180, while the remote graphic acquirer searches one of the remote graphic databases 235, 250. A search window 610 in the user interface 600 displays a list  
15        of identified graphics 620, 630, 640 meeting the search term. The search window 610 displays each listed graphic 620, 630, 640 in metadata form including a representative image and a textual description of the graphic. The representative image can be a bit-mapped image of the graphic, line drawing, a simple icon symbolizing the graphic, or other visualization element.

20                As illustrated in the exemplary display configuration 600 of Figure 6A, the user selects an entry 620 from the list of entries 620, 630, 640 in the search window and moves a pointer 645 or cursor over that entry 620. As illustrated in the exemplary display configuration 650 of Figure 6B, the user depresses a button on a mouse 141 (illustrated in Figure 1) and drags the entry 620  
25        to a desired location on the drawing page 605. The user drops the graphic 670 at the desired location by releasing the mouse button. To insert the graphic 670 at the desired location rather than merely the metadata 620 associated with the graphic 670, the user’s drag-and-drop gesture triggers the graphic locator 305 to load the full graphic file from the appropriate graphic database 180, 250, 235.

If the selected graphic 670 is located in the local graphic database 180, the graphic locator engages the local graphic acquirer 315 to load the graphic 670 from the local hard drive 127. On the other hand, if the selected graphic 670 is located in a remote graphic database 235, 250, the graphic locator 305 enlists  
5 the remote graphic acquirer 310 to download the graphic 670 from the remote graphic library 210, 220 that corresponds to the configuration 325, 330 of the remote library director 320.

When loading of the graphic is complete, the drawing software module 175 displays the graphic 670 at the intended location of the drawing page  
10 605 in a selection box 660. The selection box 660 indicates that the graphic 670 remains active and enables the user to resize, reshape, or otherwise customize the graphic 670.

Turning now to Figure 7, this figure illustrates a process 700 entitled “Search and Download Remote Graphic” for searching a remote graphic  
15 library 210, 220 and downloading graphics according to an exemplary embodiment of the present invention.

At Step 705, the IT department or other party providing a software administrative function configures the drawing software module 175 so that the remote library director 320 points to a network address of either the public graphic  
20 library 210 or the enterprise graphic library 220. The IT department can automatically set a registry key that points to the communication destination, for example. At Step 710, a user of the drawing software module 175 enters a search term into a search window 610 associated with a drawing page 605 of a user interface 600.

25 At Step 715, the remote library director 320 directs communication between the remote graphic acquirer 310 and a specified remote graphic library 210, 220. The configuration 325, 330 of the remote library director 320 determines whether the remote graphic acquirer 310 communicates with the public graphic library 210 or the private graphic library 220. This communication  
30 includes searching for graphics and transferring metadata and full graphic files.

At Step 720, the remote graphic acquirer 310 sends user-entered search terms to the specified graphic library 210, 220 for comparison with the metadata that accompanies each graphic in the remote graphic database 235, 250. A search ensuing from this communication may turn up one or more candidate  
5 graphics with metadata matching the search parameters.

At Step 730, the specified graphic library 210, 220 returns bit-mapped images and text metadata of each of these candidate graphics. At Step 735, the remote graphic acquirer 310 receives the bit-mapped images and text metadata from the remote graphic library 210, 220 specified by the state 325, 330  
10 of the remote library director 320.

At Step 740, the graphic locator 305 under the direction of the drawing software module 175 offers the user a list of the matched graphics in a metadata format as candidate graphics for insertion into the user's drawing page 605 as illustrated in Figure 6A and described above. At Step 750, the user  
15 chooses one of the candidate graphics by selecting a displayed bit-mapped image 620 and text metadata as illustrated in Figure 6B and described above.

At Step 760, the remote graphic acquirer 310 responds to the user's selection of a graphic and requests the full graphic from the remote graphic library 210, 220. At Step 770, either the public graphic library 210 or the enterprise  
20 graphic library 220 responds to the request and transmits the full graphic file to the remote graphic acquirer 310.

At Step 780, the drawing software module 175 receives the full graphic file and displays the graphic 670 on the drawing page 605. At Step 790, the user modifies the graphic 670 so that it is suited to its specific role on the  
25 drawing page 605. Modification options include resizing, moving, altering, re-coloring, reshaping, and other operations.

Turning now to Figures 8A and 8B, these figures illustrate a routine 800 entitled "Locate Graphic" for locating graphics according to an exemplary embodiment of the present invention.

At Step **803**, a user enters a search term such as “keyboard” into the user interface of the graphics locator **305** and requests a search. For example, the user can initiate a search for graphics through the search window **610** illustrated in Figure 6A.

5                   Inquiry Step **805** determines if the user has chosen to search the local graphic database **180** on the hard drive **127** of the user’s computer **120**, a remote graphic library **220**, **210**, or both the local database **180** and a remote library **220**, **210**. The user has the option to enter such search preferences through a search window **500** as illustrated in Figure 5.

10                   If the user has selected to search locally or both locally and remotely, Routine **800** executes Step **807** wherein the local graphic acquirer **315** searches the local hard drive **127** for graphics that match the search term. At Step **810**, the local graphic acquirer **315** acquires the results from the local graphic database **180** in metadata format.

15                   If inquiry step **805** determines that the user has chosen to search for graphics at a remote library **210**, **220** either in conjunction with searching the local graphic database **180** or instead of the local graphic database **180**, Routine **800** executes inquiry Step **825**. Inquiry Step **825** determines if the remote library director **320** is configured to direct remote graphic communication, including  
20 search inquiries, to a site on the LAN **151** of the enterprise graphic library **220** or a site on the WAN **152** of the public graphic library **210**.

                    If the remote library director **320** is configured to direct communication to the public graphic library **210**, Routine **800** executes Step **827** through Step **850**. On the other hand, if the remote library director **320** directs  
25 search communication to the enterprise graphic library **220**, Routine **800** executes Steps **860** through Step **895**.

                    If Step **825** results in Routine **800** directing execution flow through Step **827**, then at Step **827** the remote library director **320** directs remote search communication to the public graphic library **210** on the WAN **152**. At Step **830**,

the remote graphic acquirer **310** generates an XML document containing graphic search parameters in accordance with the search terms entered in Step **803**.

At Step **832**, the remote graphic acquirer **310** sends the XML document to the Internet ASP **335** of the public graphic library **210** that is associated with the IIS **340** of that library **210**. The XML document passes onto the LAN **151** and to the router **230** of the WAN-connected enterprise **205**. The router **230** transmits the XML document onto the WAN **152** for arrival at the address of the Internet ASP **335**.

At Step **835**, the Internet ASP **335** receives the XML document from the remote graphic acquirer **310** and, in response, queries the public SQL server **350** to identify metadata that matches the search terms. At Step **837**, the public SQL server **350** responses to the query from the Internet ASP **335** and searches the its public SQL database that is on that server **837** and that contains metadata for each graphic in the public graphic library **210**.

At Step **840**, the public SQL server **350** returns the record set containing the metadata meeting the search criterion to the Internet ASP **335**. At Step **845**, the Internet ASP **335** generates an XML document based on the record set from the public SQL server **350**. That is, the Internet ASP **335** places a list of the graphics that meet the search term along with image and text metadata for each entry in the list into an XML document.

At Step **850**, the Internet ASP **335** transmits the XML document back to the remote graphic acquirer **310** that originated the search request. This document and the search results contained therein over the WAN **152** and through the WAN-connected enterprise LAN **151** for receipt by the user computer **120**.

If the remote library director **320** is configured to seek graphics from an enterprise graphic library **220** rather than the public graphic library **210**, then at inquiry Step **825**, as discussed above, Routine **800** executes Step **860**. At Step **860**, the remote library director **320** directs search communication to the enterprise graphic library **220**.

At Step 865, the remote graphic acquirer 310 generates an XML document which can be essentially the same XML document described above in reference to Step 830. That is, in one embodiment of the present invention, Step 865 and Step 830 generate essentially the same XML document containing  
5 graphic search parameters including one or more search terms.

At Step 870, the remote graphic acquirer 310 sends the XML document to the intranet ASP 360 of the enterprise graphic library 220. The XML document travels to the address defined by the remote library director 320 which is the LAN address of the enterprise graphic library 220 within the firewall 355 of  
10 the WAN-disconnected enterprise 215. The intranet ASP 360 provides similar function to the Internet ASP 335 and accepts and receives information in the same format.

At Step 875, the intranet ASP 360 queries the enterprise SQL server 365 to identify graphics matching the search terms entered in Step 803. At  
15 Step 880, the enterprise SQL server 365 responds to the intranet ASP's query and searches its internal enterprise SQL database for matches to the user's search terms. At Step 885, the enterprise SQL server 365 returns the record set of search results and metadata to the intranet ASP 360. At Step 890, the intranet ASP 360 generates an XML document based on the record set. At Step 895, the intranet  
20 ASP 360 transmits the XML document containing search results to the remote graphic acquirer 310 at the user's computer 120.

At Step 897, the graphic locator 305 merges search results from each of the graphic databases 180, 235, 250 that were searched and that identified suitable graphics content. The graphic locator 305 also eliminates duplicate  
25 results so that each search result is associated with a single graphic database.

At Step 898, the drawing software module 175 displays the search results in metadata form, as a list of bitmapped images and accompanying text descriptors. Figure 6A illustrates an exemplary user interface 600 following this format.

From these search results, a user can select a specific graphic for downloading and insertion onto a document page. Figures 9A and 9B illustrate a routine **900** entitled "Insert Graphic" for downloading a graphic and inserting it into a drawing or other document according to an exemplary embodiment of the present invention.

At Step **905** in Routine **900**, the user originating the search selects a search result, which as described above is displayed as a bit-mapped image and text metadata on the graphic locator user interface. Figure 6B illustrates such an exemplary display **600**.

At Step **910**, the user drags and drops the selected bit-mapped image **620** into the drawing page **605**. Alternatively, the user can select this image **620** using arrow and function keyboard keys and depress the control key and the enter key in combination to move the image **620** onto the page **605**. Subsequent flow of Routine **900** proceeds according to the location of the selected graphic as determined in inquiry Step **915** and inquiry Step **932**. If the selected graphic is local, Routine **900** executes Step **920** and engages the local graphic acquirer **315** to load the selected graphic from the local graphic database **180** on the hard drive **127** of the user's computer **120**. If the selected graphic is remote, then Routine **900** executes inquiry Step **932**.

If the inquiry of Step **932** determines that the remote library director **320** is configured to the public graphic library state **325**, Routine **900** proceeds to Step **935** and the remote library director **320** directs communication between the remote graphic acquirer **310** and the public graphic library **210**.

At Step **940**, the remote graphic acquirer **310** generates an XML document containing a request to download the specific graphic that the user selected. At Step **945**, the remote graphic acquirer **310** sends this XML document to the Internet ASP **335** via the WAN **152**. That is, the request for a specific graphic transmits across the WAN-connected enterprise's firewall **355** to the address on the WAN **152** of the public graphic library **210**. This address complies with the state **325** of the remote library director **320**.

At Step 950, the Internet ASP 335 returns the uniform resource locator ("URL") for the location of the selected graphic to the remote graphic acquirer 310. A URL specifies an address of documents and other resources on a web such as the World Wide Web and typically defines a protocol and an Internet Protocol ("IP) or domain name where the resource is located. At Step 955, the remote graphic acquirer 310 uses this URL to download the selected graphic.

If the remote library director 320 is configured to the enterprise state 330 rather than the public library state 325, then following Step 932, Routine 900 executes Step 960 and the remote library director 320 directs communication between the remote graphic acquirer 310 and the enterprise graphic library 220.

At Step 965, the remote graphic acquirer 310 generates an XML document that specifies the requested graphic. Since the destination of the XML document is not required to be included in the document itself, this XML document can be essentially the same XML document generated by Step 940, which is described above.

At Step 970, the remote graphic acquirer 310 transmits the XML document to the intranet ASP 360 under the direction of the remote library director 320. The remote graphic acquirer 310 initiates the transmission and the remote library director 320 specifies the destination, which is the enterprise graphic library 220 on the LAN 151.

At Step 975, the intranet ASP 360 returns the URL for the location of the graphic to the remote graphic acquirer 310. That is, the intranet ASP 360 replies to the remote graphic acquirer's request and provides the location of the specific graphic that the user wants to place in the active drawing document.

At Step 980, the remote graphic acquirer 310 receives the URL from the intranet ASP 360 and downloads the graphic from the enterprise graphic library 220 based on the URL.

At Step 985, the routine flow converges and Routine 900 executes Step 985 whether the graphic is local or remote and whether the remote library director is configured to the enterprise state 330 or the public library state 325. At

Step 985, the remote graphic locator 305 receives the requested graphic and notifies the drawing software module 120 that the graphic is ready to be opened and placed into the user's document.

5 At Step 990, the drawing software module 175 removes the bitmapped image displayed as metadata and replaces it with the full graphic by opening the full graphic and inserting it at the location indicated by the user's drag-and-drop gesture.

10 The user can customize the graphic, for example skewing, recoloring, or resizing it. If the user requests additional searches and inputs more graphics, the graphic locator 305 repeats Routine 800 and Routine 900 to accommodate the request.

15 In summary, the present invention provides an enterprise that is isolated from a public database of graphics with a graphic database that serves the needs of the enterprise and that can comprise graphic content drawn from the public database. The present invention supports a drawing software program that conducts searches for graphics from a remote graphic database in an environment of multiple remote graphic databases. The configuration of the software program can direct search communication to a select graphic database.

20 From the foregoing, it will be appreciated that the present invention overcomes the limitations of the prior art. From the description of the embodiments, equivalents of the elements shown therein will suggest themselves to those skilled in the art, and ways of constructing other embodiments of the present invention will suggest themselves to practitioners of the art. Therefore, the scope of the present invention is to be limited only by the claims below.